# Summary

This report is the second of a series intended to provide guidance on the interpretation and uses of Dietary Reference Intakes (DRIs). The term *Dietary Reference Intakes* refers to a set of at least four nutrient-based reference values that can be used for assessing and planning diets and for many other purposes. Specifically, this report provides guidance to nutrition and health professionals for applications of the DRIs in dietary planning for individuals and groups, as well as providing the theoretical background and statistical justification for these applications.

A previous report examined the use of the DRIs in dietary assessment (IOM, 2000a). Dietary assessment using the DRIs, whether for individuals or groups, involves a comparison of usual nutrient intakes with nutrient requirements and examines the probability of inadequate or excessive intake.

Dietary planning, on the other hand, aims to optimize the prevalence of diets that are nutritionally adequate without being excessive. Dietary planning may be done at several different levels. It may refer to an individual planning a meal and food purchases, a food service manager in an institution planning food acquisition and menus, or a government agency planning large nutrition-related or food assistance programs. For the purposes of this report, dietary planning applies to planning intakes, rather than the amount of food purchased or served. Throughout this report methods for planning nutrient intakes of individuals and methods for planning nutrient intakes of groups are distinguished, as these are two very different applications.

Some of the dietary planning activities most relevant to use of the DRIs include individual dietary planning, dietary guidance, institutional food planning, military food and nutrition planning, planning for food assistance programs, food labeling, food fortification, developing new or modified food products, and assuring food safety. This document presents a framework for how the DRIs should be used and interpreted for these purposes.

## WHAT ARE DIETARY REFERENCE INTAKES?

The *Dietary Reference Intakes* (DRIs) are a set of nutrient-based reference values that expand upon and replace the former Recommended Dietary Allowances (RDAs) in the United States and the Recommended Nutrient Intakes (RNIs) in Canada. The new DRIs differ from the former RDAs and RNIs conceptually in that (1) where specific data on safety and efficacy exist, reduction in the risk of chronic degenerative disease is included in the formulation of the recommendation rather than just the absence of signs of deficiency, (2) the concepts of probability and risk explicitly underpin the determination of the DRIs and inform their application in assessment and planning, (3) upper levels of intake are established where data exist regarding risk of adverse health effects, and (4) components of food that may not meet the traditional concept of a nutrient but are of possible benefit to health are reviewed, and if sufficient data exist, reference intakes are established.

A nutrient has either an Estimated Average Requirement (EAR) and an RDA, or an Adequate Intake (AI). When an EAR for the nutrient cannot be determined (and therefore, neither can the RDA), then an AI is established. In addition, many nutrients have a Tolerable Upper Intake Level (UL). A brief definition of each of the DRIs is presented in Box S-1.

An important principle underlying the former RDAs and RNIs, as well as the new DRIs, is that these are standards for apparently healthy people—not values that are meant to be applied to those with acute or chronic disease or for repletion of previously deficient individuals.

The chosen criterion of nutritional adequacy or adverse effect is different for each nutrient and is identified in the DRI nutrient reports (IOM, 1997, 1998a, 2000b, 2001, 2002a). Requirements are typically presented as a single number for various life stage and gender groups rather than as multiple endpoints except in the case of vitamin A. A more detailed discussion of the origin and framework of the DRIs is presented in Appendix A. Recommended in-

**BOX S-1** Dietary Reference Intakes

*Estimated Average Requirement (EAR):* the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group.

*Recommended Dietary Allowance (RDA):* the average daily nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and gender group.

*Adequate Intake (AI):* a recommended average daily nutrient intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of healthy people that are assumed to be adequate—used when an RDA cannot be determined.

*Tolerable Upper Intake Level (UL):* the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a particular life stage and gender group. As intake increases above the UL, the potential risk of adverse health effects increases.

takes for the nutrients examined to date are presented at the end of this book.

Box S-2 provides a brief introduction to appropriate uses of the DRIs for planning.

## IMPLEMENTATION OF DIETARY PLANNING FOR INDIVIDUALS AND GROUPS

Regardless of whether diets are being planned for individuals or for groups, the goal is to plan usual diets that are nutritionally adequate, or stated another way, such that the probability of nutrient inadequacy or excess is acceptably low. For individuals, the goal of planning is to achieve usual intakes that are close to the Recommended Dietary Allowance or the Adequate Intake (AI). For groups, the goal of planning is to determine a usual intake *distribution* that results in a low prevalence of intakes that are inadequate or at risk of being excessive. The Estimated Average Requirement, AI, and Tolerable Upper Intake Level are used in planning the diets of groups.

Figure S-1 schematically shows the various steps involved in implementing dietary plans for individuals and groups. Details of each step are discussed below.

**BOX S-2** Uses of DRIs for Planning Intakes of Apparently Healthy Individuals and Groups

| *For an Individual* | *For a Group* |
|---|---|
| **EAR**[a]: should not be used as an intake goal for the individual. | **EAR**[a]: use to plan for an acceptably low prevalence of inadequate intakes within a group. |
| **RDA**: plan for this intake; usual intake at or above this level has a low probability of inadequacy. | **RDA**: should not be used to plan intakes of groups. |
| **AI**: plan for this intake; usual intake at or above this level has a low probability of inadequacy. | **AI**[b]: plan for mean intake at this level; mean usual intake at or above this level implies a low prevalence of inadequate intakes. |
| **UL**: plan for usual intake below this level to avoid potential risk of adverse effects from excessive nutrient intake. | **UL**: use in planning to minimize the proportion of the population at potential risk of excessive nutrient intake. |

[a]In the case of energy, an EER is provided. The EER is the dietary energy intake that is predicted (with variance) to maintain energy balance in a healthy adult of a defined age, gender, weight, height, and level of physical activity. In children and pregnant and lactating women, the EER includes the needs associated with deposition of tissues or secretion of milk at rates consistent with good health. For individuals, the EER represents the midpoint of a range within which an individual's energy requirements are likely to vary. As such, it is below the needs of half the individuals with the specified characteristics, and exceeds the needs of the other half. Body weight should be monitored and energy intake adjusted accordingly.

[b]The AI should be used with less confidence if it has not been established as a mean intake of a healthy group.

## USING DIETARY REFERENCE INTAKES TO PLAN DIETS FOR INDIVIDUALS

Planning diets for individuals involves two steps. First, appropriate nutrient goals should be set, and second, a dietary plan that the individual will consume must be developed. This is most frequently accomplished using food-based guidance systems.

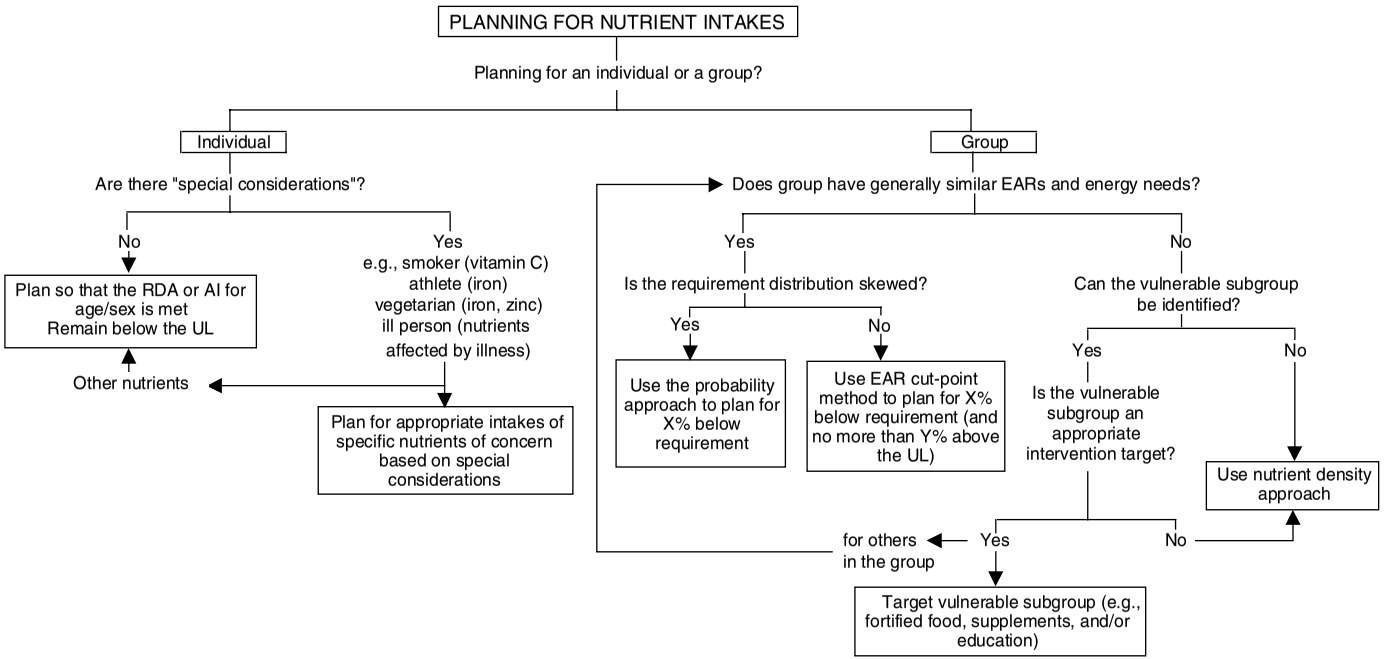


**FIGURE S-1** Schematic decision tree for dietary planning.

## *Setting the Goal*

The goal for individual planning is to ensure that the diet *as eaten* has an acceptably low risk of nutrient inadequacy while simultaneously minimizing the risk of nutrient excess for all nutrients for which Dietary Reference Intakes (DRIs) have been established. When planning for individuals for nutrients such as vitamins, minerals, and protein, a low risk of inadequacy is planned by meeting the Recommended Dietary Allowance (RDA) or Adequate Intake (AI), and a low risk of excess by remaining below the Tolerable Upper Intake Level (UL). There are neither adverse effects nor documented benefits associated with exceeding the recommended intake, provided intake remains below the UL. Planning is always for *usual* intake, defined as an individual's intake over a long period of time.

In some cases it may be appropriate to use a target other than the RDA for individuals. The RDA provides assurance that the probability of inadequacy does not exceed 2 to 3 percent. However, nutritionists and other planners may decide to use a different definition of what is an acceptably low probability of nutrient inadequacy. If so, the rationale should be clearly stated.

The EAR is *not* used as a goal in planning individual diets. By definition, a diet planned to provide the EAR of a nutrient would have a 50 percent probability of not meeting an individual's requirement, and this is an unacceptable degree of risk for the individual.

The situation for energy is quite different. In this case, there are adverse effects to individuals who consume intake above their requirements—over time, weight gain will occur. This difference is reflected in the fact that there is no RDA for energy, as it would be inappropriate to recommend an intake that exceeded the requirement of 97 to 98 percent of individuals. The only DRI available for energy is the EER (estimated energy requirement), which reflects the estimated average energy expenditure associated with an individual's sex, age, height, weight, and physical activity level. As such, it exceeds the needs of half the individuals with specified characteristics, and is below the needs of the other half. Although the EER may be used as an initial planning goal, body weight must be monitored and intake adjusted as appropriate.

Finally, it is necessary to consider the recommended distribution of energy from the macronutrients fat, carbohydrate, and protein (IOM, 2002a). For example, for adults, their energy consumed from fat should be between 20 and 35 percent.

### *Developing Dietary Plans*

Dietary plans will usually be developed using food-based dietary guidance. In the past, dietary reference standards (e.g., the former RDAs in the United States and Recommended Nutrient Intakes in Canada) have been used to provide food-based dietary guidance in several ways. These include developing national food guides and dietary guidelines for healthy individuals, providing consumer information on food and supplement labels, and serving as a reference standard for nutrient content and health claims. When dietary reference standards are revised, there will be unavoidable time lags until food guides and information on food and supplement labels are assessed and revised, if necessary, to reflect the new nutrient standards. When these gaps occur, diets of individuals must be planned using more detailed data on nutrient composition, such as those found in food composition databases. Information on food and supplement labels may be useful for estimating macronutrient contents (e.g., energy, fat, and fiber), but may be less useful in situations where the labeling reference standards do not reflect the current recommended intakes. Planners may wish to start with current food guides and then check to be certain that the resulting diets meet the RDAs and AIs without exceeding the ULs.

### *The Bottom Line: Planning Individual Diets*

The goal of planning diets for individuals is to have a low probability of inadequacy while minimizing potential risk of excess for each nutrient. In most cases, this is done by meeting the RDA or AI while not exceeding the UL. This can be accomplished by using food guides such as *Canada's Food Guide to Healthy Eating* (Health Canada, 1991) or the U.S. Food Guide Pyramid (USDA, 1992), although supplemental information such as food composition databases should also be used in situations when these guides may not reflect the DRIs. Gaps or excesses identified can then be remedied by planning to alter the type or amount of foods in the various food groups, by using fortified foods, or by using supplements.

## USING DIETARY REFERENCE INTAKES TO PLAN DIETS FOR GROUPS

Planning diets for groups is a multistep process. It involves identifying the specific nutritional goals, determining how best to achieve these goals, and, ultimately, assessing if these goals are achieved.

The goal of planning for groups is to determine a distribution of usual nutrient intakes that provides for a low prevalence of inadequate intakes and a low prevalence of intakes that may be at potential risk of adverse effects due to excessive intake. This proposed framework thus shifts the focus of planning away from using dietary recommendations in deciding what to offer or serve to what is ultimately desired in terms of the distribution of usual nutrient intakes in the group.

***By focusing explicitly on the distribution of usual nutrient intakes of a group, the framework for planning presented below is, in many respects, a new paradigm.***

The procedures used for planning intakes of groups differ depending on whether the group is relatively homogeneous (e.g., a single life stage and gender group, such as women 31 to 50 years of age), or is composed of a number of subgroups that differ in nutrient and energy requirements.

### *Planning for Homogeneous Groups*

The important steps in planning diets for a homogeneous group include:

- selecting the goals, including the acceptable prevalence of inadequacy and prevalence of intakes at risk of excessive intake, for each nutrient of interest;
- estimating the target usual intake distributions for each nutrient;
- planning a menu to achieve the target usual intake distributions; and
- assessing the results of the planning.

#### *Selecting the Goals*

The first step in planning for groups is to select the goals: what will be considered an acceptable prevalence of inadequate intakes and what will be considered an acceptable prevalence of intakes at potential risk of adverse effects. These decisions need to be made for each nutrient of interest that has an Estimated Average Requirement (EAR) or Tolerable Upper Intake Level (UL). One approach is to aim for a prevalence of inadequacy of 2 to 3 percent and a prevalence of intakes at risk of adverse effects of 2 to 3 percent.

However, higher or lower prevalences could be selected for either, and the selected prevalences may vary by nutrient.

Goals may also be set for nutrients with an Adequate Intake (AI). In these cases, the goal will usually be to achieve a median intake equal to the AI. For energy intake, the goal is to provide the mean estimated energy requirement (EER) for the group. In addition, planners will usually wish to specify goals related to macronutrient distribution, such as ensuring that the energy from fat is between 20 and 35 percent for adults.

### *Estimating the Target Usual Nutrient Intake Distribution*

For nutrients with an EAR, the next step in planning group diets is to determine the usual intake distribution that will meet these goals. This process needs to be repeated for each nutrient of interest.

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***A target usual nutrient intake distribution has an acceptably low prevalence of inadequate or excessive intakes, as defined by the proportion of individuals in the group with usual intakes less than requirements or greater than the UL. In most cases, the prevalence of inadequate intakes is estimated as the proportion of the group below the EAR, and the prevalence of excessive intakes is estimated as the proportion of the group above the UL.***

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In order to select a target usual nutrient intake distribution, it is necessary to make some assumptions about usual intake distributions for the group of interest. In some cases, the planner may have information on the current intake distribution for the group, and can use this information to plan the new intake distribution. In other cases, it will be necessary to use intake distributions from similar groups (for example, using data from national nutrition surveys). In either case, the distribution of *usual* intakes is needed, with the effect of day-to-day variation removed. Because intake distributions are seldom normal, it is usually not possible to determine the distribution from just the mean and standard deviation of intakes. Percentiles of intakes are almost always needed.

Next, the planner needs to position the intake distribution so the nutrient intake goals are met. For example, if a planner decides that the prevalence of inadequacy in the group should be set at 2 to 3 percent, then the usual nutrient intake distribution of the group should be positioned such that only 2 to 3 percent of individuals in the group have usual intake less than the EAR. Using the EAR as a

cut-point for estimating the prevalence of inadequate intakes builds directly on the approaches previously described for assessing intakes (IOM, 2000a).

It is appropriate to use the EAR as a cut-point for estimating the prevalence of inadequate intakes for all nutrients with an EAR, except iron. Because the iron requirements are not normally distributed, it is necessary to use published tables showing the distribution of iron requirements in order to estimate the prevalence of inadequate intakes (IOM, 2001).

Because the available intake distribution will not usually be correctly positioned to meet the nutrient goals, the planner must move it up (or down) by adding (or subtracting) a constant amount of the nutrient to each point on the distribution until the appropriate prevalences are obtained. When the distribution is correctly positioned, it becomes the target usual intake distribution.

Assuming there are no changes in the shape of the distribution, the amount of the shift can be calculated as the additional amount of the nutrient that must be consumed to reduce the proportion of the group that is below the EAR. For example, the EAR for zinc for girls 9 to 13 years old is 7 mg/day. Current data from the Third National Health and Nutrition Examination Survey show that about 10 percent of the girls have intakes below the EAR. If the goal is to plan intakes so that only 2 to 3 percent are below the EAR, intakes need to be increased. The amount of the increase can be calculated as the difference between the current intake at the 2nd to 3rd percentile (which is 6.2 mg/day) and the desired intake at the 2nd to 3rd percentile (the EAR of 7 mg/day); the difference is thus 0.8 mg/day. That means that the distribution of intakes needs to shift up by 0.8 mg/day in order to have only 2 to 3 percent of the girls with intakes below the EAR.

The same procedure should be followed to determine if the distribution meets the goal of a low prevalence of potentially excessive intakes. For zinc, the UL for girls 9 to 13 years of age is 23 mg/day. The 99th percentile of their current usual intake distribution is 15.5 mg/day, so even if the distribution is shifted up by 0.8 mg/day, the 99th percentile (16.3 mg/day) is below the UL.

The median of the target intake distribution is a useful summary measure, as it can be used as an initial tool in planning menus. Assuming that the shape of the intake distribution does not change as a result of planning, the median of the target intake distribution is calculated as the median of the current usual intake distribution, plus (or minus) the amount that the distribution needs to shift to make it the target usual nutrient intake distribution. In the zinc

example above, the distribution needed to shift by an additional 0.8 mg/day. The median of the current zinc distribution for these girls is 9.4 mg/day, so the median of the target usual intake distribution would be 9.4 + 0.8 = 10.2 mg/day.

The median of a target intake distribution will usually exceed the Recommended Dietary Allowance (RDA) because the variance in usual intakes exceeds the variance in requirements. The RDA for zinc for girls is 8 mg/day, but the target median intake is 10.2 mg/day. Thus, selection of the RDA as the median of the target usual intake distribution is not recommended as it results in a percentage of inadequacy greater than would likely be selected with more careful consideration.

### *Planning a Menu to Achieve the Target Usual Intake Distributions*

After the planner has estimated a target usual intake distribution for each nutrient of interest, this information needs to be operationalized into a menu. Menu planning involves several steps:

1. Establishing an initial goal for the nutrient content of the menu that is based on the target usual nutrient intake distribution.
2. Determining what foods to offer that will most likely result in a distribution of usual nutrient intake that approximates the target, and thus attains the desired prevalence of nutrient adequacy.
3. Determining the quantities of foods to purchase and serve.

#### *Step 1. Establish an initial goal for the nutrient content of the menu.*

It might appear logical to use the median of the target usual intake distribution as a goal for the nutrient content of a menu. As described earlier, this would be projected to lead to an intake distribution with the desired prevalence of nutrient adequacy, assuming that the shape of the distribution did not change. However, in almost all group-feeding situations, nutrient *intakes* are less than the nutrient content of the foods *provided* (i.e., food is not completely consumed). Furthermore, many planning applications involve offering a variety of menu options from which the members of the group will select foods. For these reasons, the planner might aim for a menu that offers a variety of meals with a nutrient content range that includes, or even exceeds, the median of the target nutrient intake distribution.

It is necessary to set initial planning goals for all nutrients of interest. For nutrients with an AI, it is not possible to estimate the preva-

lence of inadequacy, and the goal should be to achieve median intakes at the AI. Thus, the AI can be used as a planning goal if the distribution of intakes for the group of interest is similar to the distribution of intakes that was used when setting the AI. For energy intake, either a mean EER or the mean of the current energy intake distribution should be determined. An EER may be calculated for a reference person that is typical for the group of interest, or more accurately, by using an average EER for the members of the group. However, accurate estimates of heights, weights, and physical activity levels are needed to estimate an energy requirement, and these are often not available. Thus, even though it is known that energy intakes are often underreported, the mean of the distribution of energy intakes may also be used as the target in the planning process. In either case, monitoring of body weight should occur.

*Step 2. Determine what foods to offer.*

After all the nutrient targets have been set, the planner must select foods that will provide this average level of nutrient intake. To convert nutrient intake targets into food intakes, planners will usually rely on food guides such as the U.S. Food Guide Pyramid (USDA, 1992), *Canada's Food Guide to Healthy Eating* (Health Canada, 1991), published menus, and previously used menus to design a menu that is likely to result in the target level of adequacy. This will typically be an iterative process, often assisted by nutrient calculation software that allows interactive changes to menus and then recalculates the nutrient levels at each step. In addition to achieving goals for prevalence of inadequate intakes and prevalence of potentially excessive intakes, goals for acceptable macronutrient distribution ranges (IOM, 2002a) will also need to be considered.

*Step 3. Determine the quantities of foods to purchase, offer, and serve.*

Designing menu *offerings* to meet an *intake* target is a difficult task. Because food selections and plate waste vary among groups, and among menus within groups, the appropriate procedures for determining the foods to offer depend heavily on the particular planning context. In addition, the amount to purchase to be able to offer or serve must take into account food waste due to preparation losses.

### *Assessing the Results of the Plan*

The final step in planning intakes is to assess the results of the planning process. Such an assessment would follow the procedures for assessing group intakes (IOM, 2000a). There are several reasons why assessment is a crucial component of the framework for group planning.

First, planners typically can control only what is offered to individuals in the group, not what they actually eat. Because the goal of planning is to achieve an acceptable group prevalence of inadequate nutrient intakes, it is clear that to judge the success of the planning activity, assessment of intakes must occur.

Furthermore, the distribution of intakes that was chosen as the starting point for the planning activity often will not be taken from the group whose intakes are being planned. For example, it may be necessary to start with intake distributions from national surveys. Thus, the planner is making an assumption about the applicability of the distribution to the group of interest.

In addition, a crucial assumption was made when selecting the target median intake—that shifting the distribution of intakes to a new position would not change the shape of the distribution. If the shape changes, then the estimated target median intake may be incorrect. The shape of the distribution is likely to depend on many factors, including food preferences, the types of foods served, and the amount of food needed to meet each person's energy needs. Thus, there are several reasons to believe the distribution's shape may change if a different selection of foods were served. This is another reason why assessment is a crucial component of good planning.

Planning group diets is an iterative, ongoing effort in which planners set goals for usual intake, plan menus to achieve these goals, provide these new menus, assess whether the planning was successful, and then modify their planning procedures accordingly.

## *Planning for Nonhomogeneous Groups*

If nutrient or energy requirements (or both) are not uniform across a group, the approach to planning can vary. In some cases it may be possible to target the most vulnerable subgroup (i.e., that with the highest nutrient requirements relative to energy needs) for a specific intervention. In other cases it may not be possible or practical to target the vulnerable subgroup, and in these situations,

a nutrient density approach can be used. Even within a group with the same nutrient requirements, energy requirements may vary substantially, and the nutrient density approach may also be applicable.

***Nutrient density is defined as the ratio of the content of a nutrient to the energy provided by the food item, diet, or food supply. It is expressed as the unit weight of the nutrient per 1,000 kcal or per MJ of energy.***

A simple nutrient density approach for heterogeneous groups is to determine the subgroup with the highest target median nutrient intake *relative to their estimated average energy requirement.* Energy requirements can be obtained by using the current average energy intake of the subgroup, or by calculating the average EER for the subgroup. For example, in a hypothetical group of men and women combined, assume that the vitamin C target median intake for the men is 138 mg/day, and the target median intake for the women is 116 mg/day. If the average EER for the men is 2,600 kcal/day, then their target median vitamin C intake, expressed as a density, is 138/2.6, or 52 mg/1,000 kcal. If the average EER for the women is 1,800 kcal/day, then their target median intake, expressed as a density, is 116/1.8, or 64 mg/1,000 kcal. Thus, the women require a higher vitamin C density in their diets. In this simple approach, the planner would use the target median vitamin C density for the women in the menu planning process, and would assume that the men's intake would also be adequate.

However, the simple approach does not consider the actual distribution of nutrient densities within the group. A new method of planning for heterogeneous groups is proposed in this report. Its goal is to develop a *target nutrient density distribution* for each subgroup, and then choose the highest target median density from these distributions as the nutrient density to be used in planning. There are three steps to deriving a target usual nutrient density intake distribution:

1. Obtain the target distribution of usual nutrient intakes for each subgroup of interest.
2. Combine the target distribution of usual nutrient intakes with the usual energy intake distribution in each subgroup to obtain the target distribution of usual nutrient intakes expressed as densities.
3. Compare the estimated target median intake density for each discrete subgroup to identify the highest nutrient density and use this density to set planning targets for the whole group.

This approach is theoretically more likely to provide an accurate estimate of the appropriate target median intakes for heterogeneous groups, although the practicality of its use in planning has not been tested.

For either the simple approach or the target nutrient density distribution approach, this selection process would then be repeated for each nutrient of interest for the group, and planning a menu to achieve these targets would proceed as described above.

For some nutrients (notably iron), prioritization of the needs of the subgroup with the highest requirement relative to energy can result in the selection of a target median intake that far exceeds the needs of all other subgroups. Under these circumstances, planners must consider the risk that members of subgroups with lower nutrient requirements relative to energy may achieve intake levels in excess of the UL. In such situations, it may be preferable to target the vulnerable subgroups through education or supplementation.

Because the simple approach does not consider the distribution of nutrient densities, and the target nutrient density distribution approach is currently untested, it is particularly important to assess nutrient intakes as a final step in the process of planning for groups.

## SPECIAL CONSIDERATIONS

When using the Dietary Reference Intakes (DRIs) for planning dietary intakes, it is helpful to consider the process and criteria used for developing the DRIs for specific nutrients. Special considerations for planning include factors that affect nutrient bioavailability, such as the source, chemical form, and dietary matrix, as well as the physiological, lifestyle, and health factors that may alter nutrient requirements and therefore recommended intakes. These factors need to be considered whether planning diets for individuals or for groups.

Both planning and assessment often rely on self-reported intake, and thus it is important to consider the well-documented issue of underreporting of energy intakes and its effects on the accuracy of self-reported *nutrient* intakes. If intakes are underreported, then the planner may start the planning process with incorrect data on current intakes and may also incorrectly assess the results of the planning process. Unfortunately, well-accepted, validated methods to statistically correct for the effects of underreporting the estimated distribution of usual intakes are presently lacking. If planners have the means to measure intakes (e.g., by observing foods selected and

food wasted by patients in a nursing home), the results of the planning and subsequent assessment will be more valid than self-reported intakes for almost all groups.

## RESEARCH IMPLICATIONS AND RECOMMENDATIONS

Several crucial areas have been identified where data and techniques do not exist or additional knowledge is needed. These needs are synthesized and prioritized in several key areas, including research on dietary planning for groups, improving the quality of dietary intake data, providing guidance for dietary planning, and improving estimates of nutrient requirements. These areas are summarized below.

### *Implementing Dietary Planning for Groups*

- Pilot test the approaches to dietary planning for groups that are proposed in this report. The approach to group planning proposed in this report is a new paradigm, and should be tested in pilot studies before being implemented on a larger scale.
- Determine how different nutrition interventions affect intake distributions. Examination and publication of intake distributions before and after an intervention, with a systematic collection of this type of data, would allow a more informed selection of methods for planning a dietary intervention.
- Determine the intake distributions of specific population groups. Although data on dietary intakes may be available either from national population surveys or surveys of large groups, often such information has not been reported in a manner that facilitates the estimation of variations in the usual intake of individuals.
- Determine the relationship between foods offered and nutrient intake in the context of group planning. Research is needed to determine how food offerings relate to food and nutrient intakes, and how the relationship between food offered and intake varies according to planning context.
- Develop and evaluate dietary planning strategies for heterogeneous groups, including a nutrient density approach to dietary planning. Research is needed to determine the practical usefulness of planning for a target nutrient density, determine if the applicability of the nutrient density approach is limited to situations with predetermined food allocations or restricted food choices (e.g., emer-

gency relief rations), and determine if this approach would be practical in situations offering a wide variety of food choices, where the nutrient density is more dependent on food selection than on total food access to meet energy needs.

### *Improving the Quality of Dietary Intake Data*

Much has been written about ways to improve the quality of the intake data on which dietary assessment and planning are based; a number of these issues were discussed in a previous report (IOM, 2000a) and are reiterated here.

- Develop and validate statistical procedures to identify and correct for both under- and overreporting in self-reported intake data for energy and other nutrients.
- Identify and validate better ways to quantify the intake of supplements.
- Update food composition databases to include the forms and units that are specified by the DRIs.

### *Developing Approaches to Providing Guidance for Dietary Planning*

- Review and, where necessary, revise existing food guides.
- Develop technical tools for the professional.
- Educate nutrition professionals about correct uses of the DRIs.
- Assess application of the DRIs for food and supplement labeling.
- Develop and evaluate food guides for group planning.

### *Improving Estimates of Nutrient Requirements*

- Improve existing estimates of the Estimated Average Requirement (EAR) and Recommended Dietary Allowance.
- Provide better information on requirements so it becomes possible to establish an EAR for nutrients that currently have Adequate Intakes.
- Improve estimates of the distribution of requirements so that the appropriate method for assessing the prevalence of inadequacy for groups can be determined (cut-point method versus probability approach).
- Identify the factors that can alter the upper intake levels that can be tolerated biologically.